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ABSTRACT

The need for developing cognitive skills in early adolescents as they move from concrete thinking to more abstract operations has been documented. College students seeking the middle school endorsement in education were trained to utilize matrices as graphic constructs of textual materials. By examining these content matrices, prepracticum teachers were instructed to show middle school students the thinking process of forming contrasts and comparisons. During a middle school practicum experience, four student teachers taught the matrix technique within their subject area classes. Assessment of practicum teachers' abilities to implement the technique was conducted by both the researcher and cooperating teachers. Using a 25-item rating scale, training and ability to instruct middle school students in the use of the matrix technique were evaluated. To assess the effectiveness of the instruction on the middle school students, a pretest/posttest was administered. Results suggest that the matrix technique did produce an effect upon the achievement of middle school students and that teacher educators can train teacher candidates to utilize such strategies for development of thinking skills. (Author/LL)

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Teaching a Cognitive Learning Strategy: Can Teachers-in-Training Assist Middle School Students to Utilize a Matrix Technique to form Comparisons and Contrasts?

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ABSTRACT

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to Utilize a Matrix Technique to Form
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In order to foster the development of thinking skills in the formulations of comparisons and contrasts this study proposed to train college students who were seeking the middle school endorsement in education to utilize matrices as graphic constructions of textual materials. From the examination of these content matrices (Yeager, 1987), pre-practicum teachers were trained to show middle school students the thinking processes of forming comparisons and contrasts within subject areas.

Pre-practicum teachers received instruction in a matrix strategy. During middle school practicum experiences, they then taught the matrix technique within their subject area classes. Assessment of practicum teachers' abilities to implement the technique was conducted by both the researcher and the supervising teachers. Practicum teachers were able to effectively deliver instruction to their middle school students. Statistical analysis also indicated that the matrix technique did produce a significant effect upon the achievement of the middle school students.

Teaching a Cognitive Learning Strategy:
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Introduction:

The Carnegie Council for Adolescent Development (1989) has noted the crucial role of the middle school years for the development of thinking skills in early adolescents, who are developing from Piagetian levels of concrete thinking to more abstract or formal operations. The Council, therefore, advocates the direct teaching of thinking skills to middle school students. In order to facilitate the implementation of this recommendation, there is a need for teacher educators to train their students in the use of strategies to develop thinking skills in the classroom.

Research hypothesis:

The instruction of pre-practicum teacher candidates in the techniques of using matrix representations of content information from text will enable them to effectively teach middle school students to utilize this technique to develop the thinking skills of forming comparisons and contrasts.

Significance:

The need for the development of critical thinking skills in American students has been well documented (Eggen & Kauchak, 1989; Weinstein, et.al., 1989). The Piagetian concept of student development from concrete levels of thinking to formal operations was once thought to be merely a natural process of growth and development. Neo-piagetians, however, advocate the assistance of that intellectual development by formal education (Wadsworth, 1979). Furthermore, the Carnegie Council for Adolescent Development (1989) has cited the developmental suitability of early adolescents in middle schools for instruction in learning strategies and thinking skills. The Council emphasizes the crucial nature of this intellectual development in the middle schools years in order to equip students to survive the academic requirements of both secondary and higher education and for their survival in an economically complex technical society.

In order to prepare teachers to be able to assist students to develop these much needed skills, it is necessary to train prospective middle school educators to meet the need for the teaching of thinking skills within subject areas (Derry, 1988). The need to provide teachers with methods which actively engage students in the development of thinking skills is supported by Eggen and Kauchak (1989) and by Vaughan and Estes (1986).

The specific use of matrices and retrieval charts by teachers to assist the development of thinking skills was advocated by Hilda Taba (1967) in her work with teachers of social studies. Recently, Yeager (1987) has documented the effectiveness of using matrices in the study of literature to promote the development of thinking skills.

Design:

This study utilized a teacher effectiveness observational design, using two independent observers to study the effectiveness of the training of four practicum students upon their ability to instruct middle school students in the use of the matrix technique.

The study also employed a pretest/posttest design to measure the effectiveness of the use of the matrix technique by 299 middle school students on their ability to formulate comparisons and contrasts upon materials from subject area texts.

Instrumentation:

Two independent instruments were used in this study: a Likert-type rating scale and a pretest/posttest.

I. A Likert-type rating scale evaluated the effectiveness of the pre-practicum teachers' delivery of instruction in the matrix technique to their middle school students. The rating scale consisted of twenty-five items, each of which were rated independently by the researcher and the middle school supervising teachers. The behavioral items were ranked on a five point range from excellent, good, satisfactory and poor to omitted. The twenty-five items to be rated were specific instructional behaviors which had been modeled for the pre-practicum teacher candidates during training sessions in utilizing the matrix technique.

Reliability Evaluations Regarding the Rating Scale:

A. The reliability of the rating instrument was evaluated in two separate analyses. To obtain estimates of reliability of the rating scale, Cronbach's coefficient alphas were computed on (1) the combined ratings of the four student teachers by four different classroom teachers and (2) the ratings by the researcher of the four practicum students combined.

For the combined ratings of the four practicum teachers by four different classroom teachers, the coefficient alpha was .97. For the ratings by the researcher of the four practicum students combined, the coefficient alpha was .98. These alpha values indicate that the Rating Scale was highly reliable in terms of internal consistency.

B. Estimates of between-rater reliability were evaluated by computing Spearman rho correlation coefficients for each of the four practicum students on the ratings given by their supervising classroom teacher and by the researcher.

II. Middle school students' mastery of the use of the matrix technique to form comparisons and contrasts was evaluated by a pretest and a posttest. The identical pretest/posttest consisted of twenty-five items organized into a 5x5 design. Five passages compiled from a variety of middle school texts and workbooks were each followed by five comparison/contrast questions. The posttest included a separate packet of semi-skeleton matrix forms with category headings and partially filled-in columns for each passage. After they completed the matrix for each section separately, students recorded their responses on scantron cards, which were machine corrected and analyzed.

Reliability Evaluation of the Pretest/Posttest:

Analysis of this instrument using Kuder-Richardson formula 20 yielded reliability ratings of .69 on the pretest and .73 on the posttest.

Procedures:

Pre-Practicum Training Sessions:

Teacher candidates received three forty minute training sessions in the use of the matrix technique, including modeling and guided and independent practices in forming a matrix for the characters in S.E. Hinton's The Outsiders (1989), a middle school reading level novel. By the examination of these content matrices, they were trained to show middle school students the thinking processes of forming comparisons and contrasts.

Eight pre-practicum students volunteered to participate in the practicum research project. A time span of only four weeks for practicum, however, offered the opportunity for the researcher to work with only four of these volunteers. The others have offered to participate in a follow-up study during their first year of teaching in middle schools.

Implementation of the Matrix Technique in Middle Schools:

Four practicum students, three in social studies and one in reading, implemented the matrix in two Evansville, Indiana middle schools. They introduced definitions of comparison and contrast to 299 middle school students in fourteen classes of sixth and seventh grades. The pretest was then administered.

The treatment consisted of instruction by modeling the matrix technique. In the first sessions, the practicum teachers modeled the matrix technique to their middle school students, using a text passage which described a group of coyote pups found in the wilderness. The use of a matrix to analyze the characteristics of the pups was modeled on an overhead projector. These presentations were observed and rated by both the researcher and the middle school supervising teachers, using the previously described Likert-type scale to rate specific teaching behaviors.

The practicum teachers then conducted guided practice in

additional use of matrices with middle school students in their subject areas for two consecutive classes to develop student skills in forming comparisons and contrasts within curriculum subject areas.

On the third day, the posttest was administered to the middle school students to measure their achievement in the use of matrices to formulate comparisons and contrasts.

Results:

The ratings of the effectiveness of the practicum teachers were highly correlated. The Spearman rho correlation coefficients computed to estimate the reliability between raters were as follow: .97, .98, .98, and .99. These values indicate a high degree of correspondence in the ratings given by the researcher and each of the supervising classroom teachers. The high degree of correlation may be due to the very specific behavioral nature of the items on the rating scale, which precluded areas of varying interpretations of item meanings by the raters.

The evaluations indicated that the practicum teachers did master the use of the matrix technique to form comparisons and contrasts. Of the possible total rating of 125 points, they achieved the scores indicated in Table 1.

TABLE 1: RATINGS OF PRACTICUM TEACHERS' DELIVERY OF INSTRUCTION.

PRACTICUM TEACHERS	A	B	C	D
RESEARCHER'S RATING SCORES	65 52%	107 86%	124 99%	122 98%
SUPERVISING CLASSROOM TEACHERS' RATING SCORES	80 64%	114 91%	122 98%	123 98.5%

To assess the effectiveness of the instruction on the middle school students a non-independent t-test was conducted to assess the mean difference of the pretest and the posttest scores. The results are shown in Table 2. The mean for the pretest was 17.27 with a standard deviation of 3.78. The mean for the posttest was 21.33 with a standard deviation of 3.18. The obtained t value of 20.45 (298df) has a two-tailed probability of less than .0001.

TABLE 2. DESCRIPTIVE STATISTICS.

VARIABLE	N	MEAN	SD	SE
PRETEST	299	17.27	3.78	.218
POSTTEST	299	21.33	3.18	.184

TABLE 3. TWO-TAILED PROBABILITY TEST.

T VALUE	DF	2-TAIL PROBABILITY
20.45	298	.0001

The effect size (Cohen, 1977) of the difference between the means is 1.08. This indicates that the posttest mean was slightly over one standard deviation above the pretest mean. This is considered to be a large effect size (Borg, 1987) and worthy of serious consideration.

Conclusion:

The matrix technique appears to yield educationally significant results. Teacher educators can effectively train teacher candidates to utilize such strategies in direct instruction for the development of thinking skills for middle school students.

Further study into this area appears to be warranted. Efforts will be taken to expand the number of practicum students studied and to conduct analysis of covariance to evaluate the significance level of the achievement effect on the posttest, controlling for the pretest, by both practicum teachers and student grade levels.

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